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Value Analysis in the Furniture Industry

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VALUE ANALYSIS IN THE FURNITURE INDUSTRY

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Explanatory notes

References to dollars ($) are to United States dollars.

The following abbreviations have been used in this manual:

R + D	research and development
KD	knock-down

Preface

This manual introduces the technique of value analysis and its application in the furniture industry. The technique was developed in the United States of America for the metal industry, but it is applicable in the furniture industry, too. The furniture industry has a wide range of raw materials and work methods from which to choose. Value analysis has been successfully applied in the furniture industry in Finland for several years. A case-study is included to clear up many misconceptions about value analysis that exist among those not entirely familiar with it.

The views expressed in this publication are those of the author, Arto Juva, Managing Director of AJ-Consultants Ltd., Vääksy, Finland. They do not necessarily reflect the views of the secretariat of the United Nations Industrial Development Organization (UNIDO).

CONTENTS

I. BACKGROUND

Value analysis (VA) is a useful tool for product development in the furniture and other wood products industries. It was developed after the Second World War by an American, Larry Miles, who was seeking new applications for raw materials and a systematic method to assure continuous development. Several years' work resulted in a technique that resulted in better and cheaper raw materials: he called it "value analysis". Later on the technique spread to other industrialized countries. It should perhaps be called "value analysis and development".

Value analysis can be applied to many activities other than product development - such as development of operations, methods and organizations. However, it is used mostly for product development (90 per cent), where concrete results can be seen and measured in terms of money. The results are better products that are cheaper to manufacture (resulting in savings in labour and/or raw material), improved work safety etc. Even technologically advanced factories obtain savings of up to 10 per cent when design cannot be changed and up to 20 to 30 per cent when major changes in design can be made. Yet the products are better than before. The improvements come through a systematic approach, team work, creative sessions without criticism, and a comprehensive function-oriented approach.

Introduction of value analysis requires training in its application. Both skills, knowledge and - most important - attitudes have to be introduced to the members of the team applying it. The value-analysis procedure should be integrated into the product-development procedure. That may sound complicated and bureaucratic, but once it is done systematically from the beginning of product development many headaches are avoided. Good planning is half the job.

II. DEFINITIONS AND TERMINOLOGY

The term "analysis" is clear to most persons. To analyse is to find things out. A chemist analyses chemical mixtures. He finds out what compounds there are in a chemical mixture - qualitative analysis - and sometimes also how much of each compound there is in the mixture - quantitative analysis. Value analysis is an analysis of values instead of compounds in a product, part of product, method or whatever object is to be analysed. Through it the values and their portions in the object are determined.

Value analysis is not only an analysis technique but also a development technique. New values are also created in the value analysis.

The term "value" is not so clear to all. In value analysis, value is defined as function divided by cost. The more the cost of a function is reduced, the better is its value. The more functions obtained with the same cost, the better is their value. The manufacturer sees value as defined above, but to the client value is "suitability" divided by the price he has to pay for it. The more the product "suits" the client, the better is its value; the cheaper the price, the better the value is to the client.

Value analysis is a systematic, function-oriented method. It compares systematically functions and costs, creates new ideas and finds out the optimum combination of function and cost. Value analysis is a kind of philosophy that assumes everything can be made in a better way or in a less expensive way. It finds completely new, better and less expensive solutions without implying criticism of previous decisions.

III. VALUES

Values cannot be determined exactly. The price/cost ratio can be calculated precisely and expressed in a numerical form, but the function or suitability has to be agreed upon, and it can normally be expressed only verbally. This agreement, or estimation, depends on the persons who are defining the function or suitability. Their thinking is influenced by their needs and living standards; their historical, political and cultural backgrounds; fashion and trends; and weather, climate, surroundings etc. For example, what is the value of a glass of water in a desert or at a cocktail party? An umbrella when the sun is shining?

It is obvious that the function (or suitability) is also affected by the limited availability of the item or of its competitors. If the best suited raw material is not available, the next best available becomes acceptable, and users would then be willing to pay a high price for it.

Values are categorized as follows:

- Use value
- Prestige value
- Exchange value
- Reuse value
- Loss value
- Cost value

The use value indicates how practical the item is for its original purpose. A stamp has use value - to mail letters. A chair has use value - to sit on. A bicycle has use value - as a means of transportation. So has a car.

Prestige value is also called status value. In many products prestige is extra outlook, design, comfort etc. This value is often added to the use value. It adds functions but, unfortunately, usually also adds costs. Typical items having prestige value are fur coats, leather sofa sets and kitchen cabinets with solid wooden doors.

Exchange value is found in products that are changed after having been used for a while. A good car has a good exchange value, and the salesman can use this fact as a sales argument when selling a new car. In the furniture trade the exchange value cannot normally be used as a sales argument, so in carrying out value analysis in the furniture industry it has to be omitted. There are some companies that take old furniture when new items are bought from them, but this practice is a sales trick, not a normal exchange of products as in the car trade case.

Reuse value is referred to when the item can be used for a second purpose when it is no longer used for its original purpose. A package may have a reuse value. A glass originally containing mustard can be used as a milk glass when all the mustard has been consumed. Another package can be reused as a deep-freezer package, but very seldom reuse values are found for furniture. A furniture salesman cannot use the reuse value as a sales argument. Nobody has heard a salesman saying that when the client gets tired of his new dining room set, he can always burn it in his oven to get energy!

An item that has more value when lost than it had before has loss value. A special button or a club jacket has loss value. The same applies to buttons of expensive sofa sets. That is why extra buttons should be sewn in the bottom of expensive sofa sets.

An item may have cost value, when it can be considered to be an investment. The item will bring about savings, direct or indirect, and these savings can be used as a sales factor. An ergonomic chair may save because whoever sits in it works more efficiently. A well-insulated door may save in heating costs, or a good door lock may save in insurance bills. After the energy crisis many product-development teams have emphasized the cost value of their new products:

(a) New motor engines bring about saving in gasoline;

(b) Better insulated houses result in saving in heating;

(c) Longer maintenance periods result in saving in lubrication, oil and maintenance costs.

The value depends on the function and the cost or the price. The cost can be broken down into:

Variable costs	Fixed costs	Profits
Direct material cost	Production	
Direct labour cost	Marketing	
Indirect labour cost	Administration	
Other variable costs (mainly electricity)	Interest	
	Depreciation	
	Taxes	

Fixed costs and profits together are called overhead requirements.

Only variable costs are normally used in value analysis to make the calculations simple and fast enough. To get the total picture when new investments are involved, interest and depreciation should also be calculated.

The cost structure in the furniture industry is often (per cent):

Variable cost 70
  Raw material 45
  Direct labour 25
Overhead requirements 30

The figures are averages for the industry in Scandinavia. They do not apply to extreme cases such as the very labour-intensive wood-carving industry or to the other extreme of material-intensive leather upholstered furniture factories and automatic panel lines, where the labour/material ratio is different.

Based on this cost structure, costs are calculated and the price is set. The manufacturer sets the price, but it is the client who accepts or rejects it. Experience in setting prices is gained through getting a feeling of the market through trial and error.

Cost structures are compiled and analysed by filling out the form below.

Item	Product group 1	2	3	Total
Raw material				
Labour				
Overheads				

What actually is function? Before embarking on a value analysis, the team must learn a common language, and only then can it decide the function of furniture. A common language can be learned, for example, by defining the functions of a dog, bicycle, car, chair and sofa using as few words as possible.

Such an analysis is not so easy as one might think. Take the first example (dog). What kind of dog is being analysed? Is the dog to be a watch dog, a companion, a hunting aid or a dog carrying brandy to persons who are freezing on a mountain top?

The function of a bicycle could be defined as "to permit 1-2 persons to travel at a speed of 15 kilometres per hour". The function of a car could be defined as "to permit 4-5 persons to travel at a speed of 100 kilometres per hour, protected against weather and without physical stress".

The difference between a function of an easy chair and a sofa is that more people can sit on the sofa and the sofa can be used temporarily as a bed.

It is a good idea to think twice what the function of an item actually is. For example, electric bulbs are used for several purposes. The reader should determine the function of an electric bulb used in the following surroundings:

In a household
At a crossroads
In a hospital
In shop windows

Typical readers may come up with what they consider are obvious answers. However, they may be referring to "purpose" rather than to "function". If more thought is given to what is the actual function, different answers may be arrived at, as indicated below.

Surrondings	Purpose	Function
In a house	To give light	To make seeing possible
At a cross roads	To give signals	To imporve traffic safety
In a hospital	To give heat	To cure people
In shop windows	To light the goods	To make window shopping possible, to protect the goods against thieves

In value analysis:

(a) If you determine: "The function of a traffic light is to give signals" you end up thinking what else gives signals and your answer may be: a radio..., but

(b) If you determine: "The function of the traffic light is to improve traffic safety" you end up thinking what else would improve safety, and totally new ideas may occur to you: new lane arrangements, two-level crossings, tunnels for pedestrians, speed limits, policemen and video cameras controlling the traffic.

Conclusion: the more exact you are in defining the function, the better ideas will occur to you when identifying alternatives.

Before proceeding any further, the reader should attempt to define the types of value, main functions and secondary functions of a sofa bed (convertible bed), a small chair for a restaurant and a small chair for household use, using the form shown in table 1.

Table 1. Identification of functions

Item	Type of value	Main function	Other functions
Sofa bed	Use value Prestige value Cost value	Permits sitting and sleeping Is flexible	Gives prestige Design[a/] Comfort
	Loss value for mechanism	Saves space	Allows rational storage of bed linen
Small chair for restaurant	Use value Prestige value (Cost value)	Permits comfortable sitting	Gives prestige Design[a/] Comfort
			Savings in cleaning costs if well designed
Small chair for household	Use value Prestige value	Permits sitting	Gives prestige Design[a/] Comfort
			Is part of an interior furnishing "system" (dining set etc.)

a/ Aesthetically pleasing.

IV. STEPS IN APPLYING VALUE ANALYSIS

Value analysis can be applied in all areas and functions of an organization, but the most common ones are:

Product development
- Products
- Parts of products
- Production methods
- Raw materials

Operations and administration
- Fixed costs in general
- Paper work systems
- Information systems etc.

Value analysis is divided into six steps or phases. These are:

- Information gathering
- Function analysis
- Value determination
- Creating ideas
- Evaluation
- Implementation

Usually nine forms are used during the process. They are filled out by the co-ordinator or group secretary as the process proceeds. Blank forms are given in annex I; the same forms, duly filled out, are given in the case-study in annex II.

Information phase. The whole team is not necessarily needed for the information phase. The following questions are asked about an item:

What is it?
What does it do?
What is its present cost?
What is its present price?
How much is being sold today and how much was it planned to sell?
Who are the customers now and who should they be?

Form No. 1 should be filled out carefully. All drawings should be taken to the meeting of the team. A prototype or a product should also be there. The purpose is to prepare the meeting so that once the information phase is completed, the team can proceed to the function-analysis phase.

In function analysis the group splits the product into parts or components and determines the functions of each item in the product. It is important to start with the whole product and go into details part by part unless the analysis is already limited to certain details of the product. At each meeting form No. 2 (meeting report) should be filled out. It serves mainly as a check-list or a follow-up programme for the period between the meetings, although it also records time spent.

The functions are divided into groups depending on the product. For furniture these may be the following:

Type of value	Function group	Code
Use	Structure	1.1
	Establish structure	1.1.1
	Give strength	1.1.2
	Join elements	1.1.3
	Other use functions	1.2
Prestige	Design	2.1
	Comfort	2.2
	Other prestige	2.3
Cost	Cost	3.1
	KD construction	3.2
Package	Package	4.

The purpose of the codes is to make the writing easier when filling in the forms. The co-ordinator will soon know the codes by heart.

Note that the KD construction is included in cost value because it saves in transportation and in warehousing.

A different kind of grouping would most likely be obtained for another industry. However, this "standard" makes the function analysis easier. The function has to be known and be given the right code. The calculations will then be simplified. It is also practical to separate the package, because then later on the packing costs can be compared product by product. Packing cannot be easily grouped with other values, so it has been found useful to separate it.

Value determination is a phase that can be done by the co-ordinator alone. After the function analysis is completed, the costs are calculated for each function. If an item has more than one function code, the cost has to be split to cover each code. This can be done either by using common sense or by thinking along the following lines:

Part: Design hinge
Cost: $1.50
Values: Use
Prestige

There is a simple way of dividing the cost as follows: if a standard hinge would cost $0.50, then there is a use value per component of $0.50 and prestige value per component of $1.00, the $0.50 being the lowest cost of a hinge having the same function (to open the door).

In determining the value, the part-function matrix must also be filled out. This will reveal very interesting information. Not only can the costs of each part be found, but also the cost of each function. After analysing several products in the same product group, one can collect information in a table and analyse it (see table 2).

Table 2. Allocation of functions by item code
(Percentage)

Product	Code							
	1.1.1	1.1.2	1.1.3	1.1	1.2	2.1	2.2	etc.
Sofa "Helsinki"	20.1	5.2	8.4	33.7	5.1	33.3	22.2	...
Sofa "Lahti"	19.0	6.0	8.5	33.5	-	30.3	22.0	...
Sofa "Vääksy"	21	4.0	6.0	31.0	2.1	29.1	40.1	...
etc.								

This information reveals that much of the cost of the sofa "Vääksy" is allocated to code 2.2 (= comfort). Now if this chair is really comfortable the value is acceptable, remembering that

$$\text{Value is defined as } \frac{\text{Comfortability}}{\text{Cost of comfort}}$$

If, however, this sofa is not more comfortable than the others, there must be something wrong. The value is low, and the team has to do something about it.

The creative phase is the most interesting phase. The cost and the function of each item in the product are obtained from the forms. The team "creates" ideas item by item by asking what else would do the function in a better or less expensive way.

All ideas should be written down as they come along. No criticism is accepted during this phase so that as many ideas as possible are created, which is important because the first 50-80 ideas for each product are usually the logical solutions or alternatives; it is only after that number is identified that the really good ideas emerge.

To prevent criticism, a standard rule in many factories is that the one who makes any negative comments about any idea has to buy coffee for everybody in the team. Even a crazy idea may get the other members of the team to think in an uncommon way, and they may then get good ideas. This is the strength of brainstorming sessions without any criticism.

The evaluation phase takes place after a while. The co-ordinator or a cost technician will by then have calculated the effect of the ideas suggested on the cost of the product. The team then selects the ideas to be implemented and identifies the ideas that are worthy of further development in the future.

The implementation phase brings with it hard work. The question to be decided is who does what and when.

The implementation has to be planned and controlled like any other project or activity. Finally, the summary form is filled out, and the actual savings and improvements in the product appear. Knowing how much time and money were spent on the process, the benefits of value analysis can be determined accurately.

V. VALUE ANALYSIS IN PRODUCT DEVELOPMENT

Product development and marketing can be compared to an aeroplane taking off:

(a) A product can be taken into production shortly after the first product idea has crystallized; but, because of poor planning, it does not turn out well, and sales drop quickly. This is often the case when either there is a great need for new products or the company believes it has a good idea. This is called an "unsuccessful take-off";

(b) The product has been planned and developed long enough, and it is believed that there is nothing wrong with it. However, the good initial sales of the product are no longer increasing, but are even slowing down. It may then be decided that the product has to be improved somehow, and a technician is given the task of making changes in it. A new version of the product is obtained, resulting in improved sales figures, which, however, after a while decline again. This is called "short flight", and the product improvement is an "unsuccessful rescue operation";

(c) The planning time may be compared to the aeroplane's runway. Good aeroplanes need a long runway. New products need good, systematic planning over a long enough period. The marketing staff often draw product-life curves, but in doing so they forget the planning time. A product for which value analysis has been made may need a long "runway" and good engines, but it will fly far and high. Thus, systematic product development is a good investment.

Common causes for failure in product development are:

(a) Lack of time. Management does not have enough time to concentrate on such things as new products. It does not have time to get the team together or to collect enough information. The product has to be on the market too soon to permit value analysis to be done;

(b) Lack of information. Not enough information has been collected about the clients' actual needs, about competitors' products, manufacturing methods and raw materials;

(c) Lack of ideas. It is impossible to sit down and decide to create at one moment good new ideas for next year. Through a creative session of value analysis, the maximum number and the best and wildest ideas can be found. The imagination is free to travel, and an idea generates more ideas in the heads of the team;

(d) Misconceptions. Often ideas are killed without carefully studying them in the belief that "the client would not accept it" or "that jigs and tools would be too expensive";

(e) Changing circumstances. The product could still be made in the same way as 15 years ago, but certain things have changed:

(i) New, better raw materials are available;
(ii) New methods and machinery are available;
(iii) The client expects to get something new;
(iv) The relative costs of utilities, labour and the prices of raw materials are different from what they were when the product was first designed;

(f) Fears. Very often people are afraid to express their ideas and opinions, being afraid of losing their reputation as furniture product-development specialists. A new idea may be suggested. It may work out well, but there is no assurance of success;

(g) Habits and attitudes. People are often suspicious of other people's ideas or opinions. It is easy to accept the idea that new products shall be made the same way as the old ones were - the risks are limited - but there is a risk of not creating good new prodcts.. It is easy to say:

"This functions well - we don't want to change it now";
"This is better than our competitor's product";
"There are no other raw material resources".

By using value analysis in product development the above-mentioned troubles can be eliminated.

In value analysis all information concerning function and cost, marketing, manufacturing and raw materials should first be collected. New ideas will be created systematically by a team. All ideas will be listed, carefully studied and evaluated. Finally, the idea with the highest value will be implemented.

Without value analysis, initiative and imagination can easily be killed in an organization by any of the following attitudes:

"We cannot change anything now";
"These are orders from the top";
"We will come back to this later on";
"There is no time now to look for better solutions. If we do so, the competition will beat us";
"This is my job. I do not want to interfere with the job of others";
"This has been tried before";
"Nobody knows about this better than I do";
"You must stick to the rules";
"I am still your boss and you do what I tell you";
"In our company we do that differently. Once you have been with us for a couple of years you may be able to make worthwhile suggestions".

The following comparison points out differences between traditional cost reduction and value analysis:

Traditional cost reduction	Value analysis
1. The product is analysed.	1. The function is analysed.
2. The work is usually done by only one person.	2. Group work results in more knowledge.
3. The only reason for reducing costs is to increase profit.	3. The reason for reducing costs is to look for value, i.e., to produce a better value and quality for the consumer.

4. Traditional cost-reduction procedures make the company more competitive in the short run, but omit research.	4. Value-analysis procedures find new market areas, end-use areas and develop R and D potential.

Summing up, the goal in the traditional cost-reduction approach is to save money, whereas the goal of value analysis is to increase value.

Figure I shows a well-planned product-development process. There are two value-analysis procedures in the process. The goal of the product-development work is to have also methods, work flow and quality standards ready after planning is completed. On the marketing side, the product's pricing is part of the integrated product development.

The description of the process, step by step, is given below:

1. Somebody gets an idea. Usually this is the designer or a marketing-minded person in the organization. The need for new products will be noted when sales statistics show negative trends. Also competitors' success may serve as a trigger. The need may come from either inside or outside the organization. Normally in a creative organization there are several ideas in an "idea bank";

2. Some key figures and sketches are required for the decision to accept the idea to be taken. The designer and the product manager (marketing manager) normally do this as a two-person team;

3. Quick value analysis is then carried out. The purpose is to find the right track as soon and as easily as possible. This procedure also eliminates excess prototype making. There are normally four to six persons in the team, depending on the size of the organization;

4. The idea bank is too often in the individuals' heads. It is not a big task to organize an idea bank. All that is needed is a file and a filing system. It is good to go through the files every now and then. Through it ideas that have not yet been analysed and implemented are always available. One person should be in charge of the idea bank;

5. The results of the quick value analysis are then presented to the product development team, the same team that is co-ordinating and supervising value analysis in the organization. It accepts or rejects proposals;

6. The technical department then prepares drawings for making the prototype, and the buyer buys materials that are not in stock. The prototype is made;

7. Value analysis takes place as described in this manual. The value-analysis team may consist of persons who did not do the quick value analysis. It will produce ideas for the idea bank and will not limit itself to use ideas to be implemented immediately;

8. The results of the value analysis are then again taken up by the product-development team. It will take the final decision;

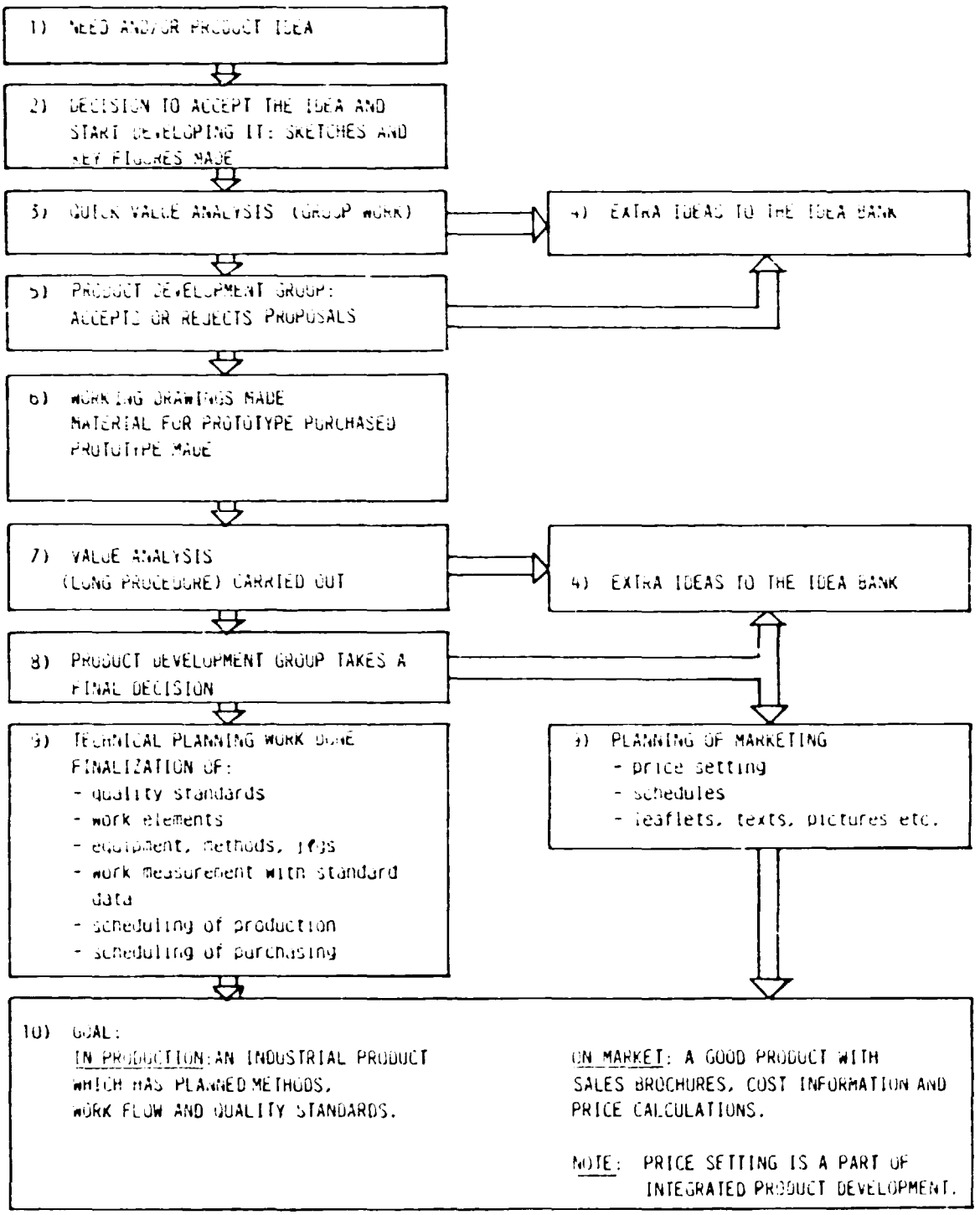

Figure 1. Value-analysis procedure for product development

9. At this point the technical department finalizes many technical product-development tasks that have already been covered during the value analysis. These jobs will thus also be simplified because these persons are familiar with the tasks to be done, being members of the value-analysis team. At the same time, the marketing department plans its marketing procedures, sets the prices and prepares sales brochures etc.

VI. INTRODUCING VALUE ANALYSIS IN A COMPANY

When a decision to introduce value analysis in a company has been taken, a training course should first be carried out. This course should take place in the company, and the items to be analysed should be taken from among the company's products. It is advisable to have the instructor follow up for a while the work of the newly established team, so that application of the concept will get off to a good start.

The goals for the value analysis should be established and should include the following:

Schedule
Plan for personnel resources
Budget, including prototypes and other product-development costs
Qualitative goals referring to
- Product policy
- Price ranges
- Savings
- New products as against improvement of old products

A small company normally has only one value analysis team. The chairman is called the "co-ordinator". He often reports to the marketing manager or in some cases to the managing director. Even in a small company value analysis has to be team work.

In larger companies where there are many products or product lines to be developed the organization shown in figure II is common.

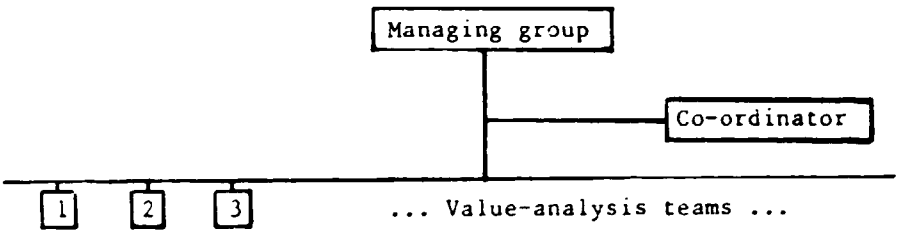

Figure II. Organization of value analysis in a large firm

In a factory producing solid-wood furniture, panel furniture and upholstered furniture, a value-analysis team may be created for each product line.

The managing group consists of the managers that normally determine the company policy, especially its product policy. The responsibilities of the group are:

To appoint the co-ordinator and the teams
To set the master timetable for the value analysis
To define priorities and goals
To supervise and control value analysis in the company

The co-ordinator has a full-time job and his responsibilities are:

To act as chairman (and secretary) of all the value-analysis teams
To act as a secretary of the managing group
To collect all basic information for new products
To prepare all necessary reports
To prepare all meetings thoroughly so that decisions can be made without wasting time
To report to the managing group on the implementation of the accepted projects and follow-up on all projects.

The value-analysis teams meet regularly every week. The team members represent all main functions of the company, such as product development, production, materials management and sales or marketing. The optimal size of a team is five persons, and a team should always have at least three, but not more than seven members. The members spend only 5-10 per cent of their weekly working time in these meetings. A member may sometimes be a member of several teams, and then his participation would exceed 10 per cent.

A team should have three to four objects being analysed at different stages concurrently. It is thus possible to jump from one product to another if for some reason there should be no possibility of proceeding with the first product.

The decisions and the follow-up tasks should be marked on value-analysis forms so that everybody knows the decisions taken at the previous meeting and also the tasks expected of him in the meantime. The forms are the base of the documentation and communication; excess writing of more formal communications is thus eliminated.

VII. APPLICATION OF VALUE ANALYSIS TO OTHER WOOD PRODUCTS

To broaden the reader's view of value analysis, it is useful to consider the application of value analysis to products commonly found. Take a wooden product - a door, for instance.

The first step is to analyse the categories of the values of the product in general. Like a piece of furniture, a door has the following values:

Use value
Prestige value
Cost value

What are the cost values and functions of the door? A door has at least the following cost values and functions:

(a) Its insulation saves in heating;

(b) Its safety lock may save on insurance costs, and it keeps a burglar away.

In their marketing, door manufacturers call attention to both these functions.

The results of an exercise to determine the types of value and functions of an outer door, an inner door and a window are given in table 3.

Table 3. Determining types of value and functions of common items in a house

Item	Types of value	Main functions	Other functions
Outer door	Use Cost Prestige	Permits movement from and to the house	Insulates; absorbs sound; improves the appearance of the house; protects against thieves
Inner door	Use Prestige	Permits movement from room to room and absorbs sound	Improves the appearance of the interior; affords privacy
Window	Use Cost Prestige	Gives light to the house and permits seeing inside the house	Permits seeing out without letting moisture in and heat out; permits fresh air to come in quickly; absorbs sound; improves the appearance of the house

VIII. SHORT PROCEDURE—QUICK VALUE ANALYSIS

In connection with the product-development procedure, it was mentioned that the normal value-analysis procedure may be extremely time-consuming, and for this reason a short procedure - quick value analysis - has been developed. This procedure uses only two forms and jumps quite soon into the creative phase and then to the evaluation.

Quick value analysis should be used:

(a) When an idea is still at a very rough stage and more ideas are needed (i.e., more creativity);

(b) When time is a limiting factor.

The best applications for quick value analysis are at the beginning of product development, when only a product idea exists (a rough sketch or the very first prototype).

The quick-value-analysis forms are given in annex I. On the first form (see form No. 10) the co-ordinator presents his opinion about the function of each part, and cost information is also presented. The team creates new ideas using this information on the second form (see form No. 11). A separate sheet should be used for each part. The savings are estimated (if possible) at the end of the meeting, and the ideas put forward are either accepted or rejected. A good idea may also end up in the idea bank of the company.

The result of the work of this quick-value-analysis team is then presented to the management, which accepts or rejects it. If the decision is positive, a prototype with drawings is constructed, and an entire long value analysis is then carried out.

Annex I

FORMS

Used in value analysis

1. Job definition and basic information
2. Meeting report
3. Function analysis
4. Function cost analysis
5. Function cost analysis matrix
6. Value determination
7. Creative phase
8. Evaluation
9. Project summary

Used in quick value analysis

10. Function cost analysis
11. List of ideas

Used in product costing and pricing

12. Product cost
13. Part/operation matrix

Form No. 1

JOB DEFINITION AND BASIC INFORMATION

Product _____ Project No. _____

Part _____ Drawings No. _____

Price/piece _____

Pieces/year _____

Cost/year _____

Goal savings _____ Per cent = _____ $/year

Estimated costs _____ $

Savings/first year _____ $

Time reserved for value analysis _____ man-hours

Project team: Co-ordinator _____

Members _____

Time and place of meeting: _____

Definition of the depth of the analysis and parts and properties that have to be retained

Appendices

Form No. 3

MEETING REPORT Page /

Product Project No.

Date

Meeting No.

Present were:

No. of persons x duration h = man-hours used

FOLLOW-UP

No.	Description of follow-up action	By whom	When	Remarks
	Appendices			

Form No. 3

FUNCTION ANALYSIS

Page /

Product

Project No.

Date

Part	Main function	Value Code	Other functions	Value Code

Form No. 4

FUNCTION COST ANALYSIS

Page /

Product

Project No.

Date

Part	Function	Value	COST R-M	Labour	TOTAL	Per cent
Total						

Form No. 4

FUNCTION COST ANALYSIS MATRIX

Product _____ Page ____/____ Date ____/____ Functions Part												Cost of part	Per cent
Cost of function													
Percentage of total													
Is the cost too high?													

Form No. 6

VALUE DETERMINATION Page /

Product

Project No.

Date

Value type/Function	Cost	Percentage of total

Comments

Form No. 7

CREATIVE PHASE Page /

Product Project No.

Date

Part	Ideas		Cost effect
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
	10		
	11		
	12		
	13		
	14		
	15		
	16		
	17		
	18		
	19		
	20		
	21		
	22		
	23		
	24		
	25		
	26		
	27		
	28		
	29		
	30		

Form No. 8

EVALUATION Page /

Product Project No.

Part Date

Main Functions:

Idea No.	Part	Advantages	Disadvantages

Form No. .

PROJECT SUMMARY

Product	Project No.
Part	Drawings No.
	New price/piece
	Pieces/year
	Cost/year

Goal savings	per cent =	$/year
Previous costs		$ year
New costs		$/year
Savings	per cent =	$/year
%-savings =		
Cost of analysis		$
Other costs		$
First year savings		$

Comments:

Ideas to be further developed:

Form No. 10

[illegible],
[illegible]

Product ____________________ Project No.: ____________________

Date ____________________ Client: ____________________

Present were ____________________

Total persons x duration h = man-hours

Parts and its functions	Stand[+)]	Cost			Per cent-age
		Wages	Raw-mat.	Total	

+) Is the part according to the company standards, yes or no.

Form No. 11

[illegible] VALUE ANALYSIS

LIST [illegible] ITEMS

Product _____ Project No. _____

Date _____

Present _____

Part	Ideas	Savings	A/R +)	Comments
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			

+) Accepted/Rejected

Form No. 12

PRODUCT COST FORM

PRODUCT: _____

Estimate ☐ Prototype ☐ Control ☐

MATERIALS	Net	Utility ratio	Gross	1) a'/ $/prod.	19___ $/prod.	2) a'/ $/prod.	19___ $/prod.	3) a'/ $/prod.	19___ $/prod.
Total raw material cost									

Capacity required	min/pcs	eff-%	min/pcs	$/min	$/pc	$/min	$/pc	$/min	$/pc
Direct cost total									
Capacity needed	min/pcs	eff-%	min/pcs	$/min	$/pc	$/min	$/pc	$/min	$/pc
Overhead									
Standard price									
Standard price incl. tax									
Chosen price									
Chosen price incl. tax									
Chosen overhead contribution									
Chosen overhead contribution									

COMMENTS _____

Form No. 13

PART/OPERATION MATRIX FORM | PRODUCT: | BY | PAGE /

PART / OR TOOL / Description / Dimensions / OPERATION																					TOTAL
	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	min/prod
TOTAL																					

Annex II

CASE-STUDY OF A SAFARI CHAIR

The case-study is for a light chair called "Safari".

The chair, made out of white pine and canvas, was exported KD-constructed in a carry-away package. The company producing it felt that there was space on the market for that type of a chair, but the feedback from the retailers was:

(a) The price was a bit too high;

(b) The design could be slightly changed;

(c) The chair was not very comfortable.

The marketing manager wanted to improve the value of the product and suggested to the management that the chair be given a value analysis. The co-ordinator was given the assignment to prepare form No. 1, which was accepted by the managing team. Then he took a chair (figures III and IV) and form No. 1 to the next meeting of the value-analysis team. He also asked the cost technician to update the cost calculations of the product (form No. 12).

At the meeting the team began by studying the assignment, then read through the papers and divided the chair into elements to be analysed, although it was not easy to define the parts because the product could not be split clearly into legs, seat, back and arm rests.

The team agreed upon the following list:

Safari chair
Items to be analysed
Total chair as such
Side
  Upper side part
  Middle side part
  Lower side part
  Dowels and glue
Legs
  Front
  Back
Front cross bar
Back cross bar
Seat
  Canvas
  Side parts of canvas
  Wood piece
  Screws (3 x 2)
  Front round support (wood)
  Back support (wood)

Figure III. Safari chair before value analysis

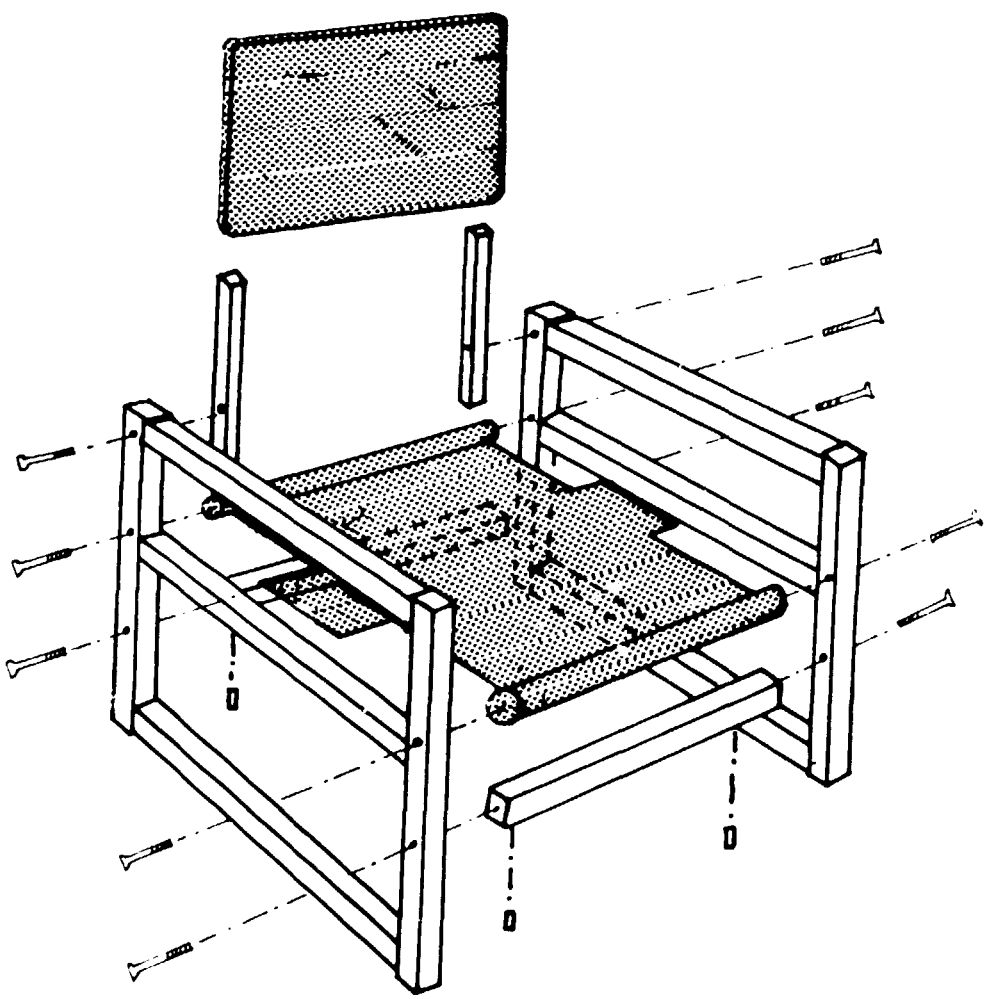

Figure IV. Safari chair to be analyzed

JOB DEFINITION AND BASIC INFORMATION (form No. 1) 82-03-31

Product SAFARI

Part

Project No. 82-07

Drawings No. 78-52

Price/pcs about 140 FIM

Pcs/year about 2'000

Cost/year 90.5 × 2'000 = 181 000

Goal savings 10 per cent = 18 100 FIM/year

Estimated costs 25h × 50 + 1000 2 250 FIM

Savings/first year 15 850 FIM

Time reserved TWO MONTHS, 25 man-hours

Project team Co-ordinator: A.J.

Members K.E, HL, PM, JP

Time and place of meeting TUESDAYS 9 a.m. to 11 a.m

Definition of the depth of the analysis and parts and properties that have to be retained

- A SAME KIND OF PRODUCT FOR THE SAME MARKET, EVEN ABOUT THE SAME PRICE RANGE ? OR A LITTLE LESS EXPENCIVE

- CHANGES IN DESIGN ACCEPTABLE

- RAW MATERIALS : WOOD & CANVAS

Appendices DRAWINGS
PRODUCT CALCULATIONS

PRODUCT COST (form No. 12) | PRODUCT: Safari Chair

Estimate ☐ | Prototype ☐ | Control ☒

MATERIALS	Net	μ	Gross	1) a'/ FIM/prod.	19___ FIM/prod	2) a'/ FIM/prod.	19___ FIM/prod.	3) a'/ FIM/prod.	19___ FIM/prod.
Pine m^3	.0143	.5	0.0286	800,-	22.88				
Canvas m			0.70	25,-	17.50				
Varnish	.150	1/3	0.450	10,-	4.50				
Accessories					5.00				
Packingmaterial					10.00				
Total raw material cost					59.88				

Capacity required	min/pcs	eff-%	min/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs
	55.15	90	61.28	.50	30.64				

Direct cost total: 30.52

Capacity needed	min/pcs	eff-%	min/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs
Overhead	55.15	90	61.28	.80	49.02				

Standard price: 139.54

Standard price incl. tax: 162.29

Chosen price:

Chosen price incl. tax:

Chosen overhead contribution FIM/pcs:

Chosen overhead contribution FIM/min:

COMMENTS

PART/OPERATION MATRIX (form No. 15) | PRODUCT: Safari chair | 82-04-07 | BY | PAGE 1 / 2

PART / Picture / Description / Dimensions (mm) / OPERATION	Front leg 2 545 × 45 × 45				Back leg 2 545 × 45 × 45				Side parts 6 506 × 45 × 45				Cross bars 2 506 × 45 × 45				Back wood pcs. 2 340 × 30 × 20				TOTAL
	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	min/prod
[illegible]	2	1	.10	.20	2	1	.10	.20	6	1	.10	.60	2	1	.10	.20	2	1	.05	.10	1.30
Edging	↓	↓	.11	.22	↓	↓	.11	.22	↓	↓	.11	.66	↓	↓	.11	.22	↓	↓	.05	.11	1.43
Planing	↓	↓	.09	.18	↓	↓	.09	.18	↓	↓	.09	.54	↓	↓	.09	.18	↓	↓	.04	.09	1.17
Trimming	↓	↓	.09	.18	↓	↓	.09	.18	↓	↓	.09	.54	↓	↓	.09	.18	↓	↓	.04	.09	1.17
Drill 1st end											.29	1.74	↓	↓	.29	.58					2.32
2nd end																					
Drill side 1	2	1	.19	.38	2	1	.19	.38									2	1	.19	.38	1.14
side 2	↓	↓	.19	.38	↓	↓	.19	.38					2	1	.19	.38					1.14
End moulding	↓	↓	.21	.42	↓	↓	.21	.42	6	1	.21	1.26	↓	↓	.21	.42					2.52
Planing	↓	↓	.42	.84	↓	↓	.42	.84	↓	↓	.42	2.52	↓	↓	.42	.84					5.04
Sanding with belt	↓	2	.05	.20	↓	2	.05	.20	↓	2	.05	.60	↓	2	.05	.20					1.20
Sanding manually	↓	1	.35	.70	↓	1	.35	.70	↓	1	.35	2.10	↓	↓	.35	.70	2	1	.15	.30	4.50
Filling	↓	↓	.20	.40	↓	↓	.20	.40	↓	↓	.20	1.20	↓	↓	.20	.40					2.40
Sanding between sprayings	↓	↓	.30	.60	↓	↓	.30	.60	↓	↓	.30	1.80	↓	↓	.30	.60					3.60
Lac spray	↓	↓	.20	.40	↓	↓	.20	.40	↓	↓	.20	1.20	↓	↓	.20	.40					2.40
Sanding ends											.15	.90	↓	↓	.15	.30					1.20
Stars internally																					
Packing																					
Screws & fittings																					
Cutting & sewing																					
TOTAL				5.10				5.10				15.66				5.60				1.01	32.53

PART/OPERATION MATRIX | PRODUCT: Safari chair | 82-04-07 | BY | PAGE 2 /2

PART / Picture / Description / Dimensions / OPERATION	Round supports 2 506 × Ø 43				Common operations				Upholstery				Transfer from page 1								TOTAL
	per piece	per type	min/pc	min/piece	per piece	per type	min/pc	min/piece	per piece	per type	min/pc	min/piece	per piece	per type	min/pc	min/piece	per piece	per type	min/pc	min/piece	min/piece
[illegible]	2	1	.10	.20												1.30					1.50
[illegible]	↓		.11	.22												1.43					1.65
[illegible]			.09	.18												1.17					1.35
[illegible]			.09	.18												1.17					1.35
[illegible]			.29	.58												2.32					2.90
[illegible]			.29	.58																	.58
[illegible]	↓	↓	.19	.38												1.14					1.52
[illegible]																1.14					1.14
[illegible]																2.52					2.52
[illegible]																5.04					5.04
[illegible]																1.20					1.20
[illegible]	2	1	.35	.70												4.50					5.20
[illegible]			.20	.40												2.40					2.80
[illegible]			.30	.60												2.60					4.20
[illegible]			.20	.40												2.40					2.80
[illegible]	↓	↓	.15	.30												1.20					1.50
[illegible]					1	2	.83	1.66													1.66
[illegible]					↓	↓	1.07	2.14													2.14
[illegible]							.50	.50													.50
[illegible]												13.60									13.60
TOTAL				4.72				4.30				13.60				32.53					55.15

Back

Wood pieces (2)

Canvas

Screws and nuts

KD fittings (2 x 5)

Hexagonal wrench

Screwdriver

Carry-away package

Function analysis was then started. First, the team determined the whole chair's function. The co-ordinator wrote down the functions and gave also the value code, using as few words as possible, i.e., he would write down just "strength" if it was obvious how the item analysed made the chair stronger (form No. 3).

At the end of the meeting the co-ordinator filled in the meeting report form (form No. 2). The team agreed about the interim follow-up programme, i.e., what had to be done before the next meeting.

During the week the co-ordinator distributed the cost of material and direct labour to all function groups. In most cases he had to use common sense. However, when common sense is always used the same way, information that is comparable to other products in the same product group is obtained. When a full-time co-ordinator is employed the calculations will be more reliable.

On form No. 4 the co-ordinator collected the direct costs of the product per value type. For instance, for construction there was canvas for structural purposes and for giving comfort. How was its cost to be divided? It may be possible to determine what would be the cheapest thing to make the construction and what would it cost. The answer is that the cost of construction and the remainder of the cost of the canvas will be the cost of comfort. It is as simple as that. Sometimes rough figures (50-50 or one third-two thirds etc.) have to be used.

On form No. 5 he collected the cost of each function in matrix form and cross-checked his calculations. The calculations can be made fast enough with a normal calculator. He used the space below to comment on the percentages. He also filled out form No. 6, but the team members made their comments on the space reserved for that effect at the next meeting.

In this particular case, form No. 5 did not show anything very dramatic. The package cost was high, but that was expected. However, form No. 5 was a good tool for the team members when they started creating new ideas. From it they learned much more about the cost structure of the product.

At the beginning of the next meeting the team received forms Nos. 4, 5 and 6. They discussed their findings briefly and asked the co-ordinator to write down their comments on form No. 6.

At that point the most exciting phase started. The co-ordinator prepared form No. 7 for himself. He reserved a blank sheet for each part so that he could write down all the ideas as they came at the next meeting. He asked the team to create ideas for the chair as such. He continued going on item by item, but returned to an item if one of the team asked to go back to it.

FUNCTION ANALYSIS (form No. 3) Page 1/2

Product SAFARI Project No. 82-07

Date 82-04-06

Part	Main function	Value Code	Other functions	Value Code
The CHAIR	To allowe sitting - for one person - comfortably ? In second living room or at country side house	 1.1 1.2	Functions as part of pine furniture set	2.1
SIDE				
- upper part	As armrest	1.1.1	Construction Strength	1.1.1 1.1.2.
- middle part	Construction	1.1.1.	Strength Allowes attaching of canvas	1.1.2. 1.1.3.
- lower part	Design	2.1.	Construction ?	
LEGS				
- front	Construction	1.1.1		
- back	Constr.	1.1.1	Design ? All. attaching of the Back	2.1 1.1.2.
FRONT CROSS BAR	Strength	1.1.2		
BACK CROSS BAR	-"-	1.1.2		
SEAT				
- Canvas	allowes sitting	1.1.1	Design	2.1
- Side part of canvas	gives strength	1.1.2	Design	(2.1)

1/ [illegible]

FUNCTION ANALYSIS Page 2/2

Product SAFARI Project No.

Date

Part	Main function	Value Code	Other functions	Value Code
SEAT cont'd				
- wood pcs	Joints	1.1.2		
- round supports	Construction	1.1.1	Roundness	2.2
	Strength	1.1.2	gives comfort	
	Joints (canvas)	1.1.3		
- screws	Joints	1.1.3		
- thread + seams	Joints	1.1.3		
BACK				
- wood pcs	Joints	1.1.3		
- thread + seams	Joints	1.1.3		
- canvas	Construction	1.1.1	Design	2.1
	i.e functions as back of		the seat	
	Tilts = comfort	2.2		
- fittings	Tilts = Comfort	2.2		
KD - Fittings		3.2.		
PACKAGE (carry-away)	Protects = Package	4		
	Saves clients trouble, acts as sales promoter			
Surface Finish	Design, out look	2.1	Cost value, easy to clean	(3.1)
Filling (putty)	Design, out look	2.1.	Cost value easy to clean	(3.1)

MEETING REPORT (form No. 2) Page 1/1

Product SAFARI

Project No. 82-07

Date 82-04-06

Meeting No. 1

Present were AJ, PM, HL, KE, JP

No. of persons 5 x duration 2 h = 10 man-hours used

FOLLOW-UP

No.	Description of follow-up action	By whom	When	Remarks
1.	Study possibilities of using different quality wood. Prices?	AJ	→ Next meeting	
2.	Check the sales forecast of "SAFARI"	PM	Till Next Meeting	
3.	Calculate forms 4...6	JP	— " —	

Appendices None

FUNCTION COST ANALYSIS (form No. 4) Page 1/1

Product SAFARI Project No. 82-07

Date 82-04-07

Part	Function	Value	COST R-M	Labour	TOTAL	Per cent
SIDE						
- upper	construction	1.1.1	3.05	2.90	5.95	
	strength	1.1.2		.92	.92	
- middle	construction	1.1.1	3.05		3.05	
	strength	1.1.2		2.90	2.90	
- lower	design	2.1	3.05	2.90	5.95	
LEGS						
- front	constr.	1.1.1	3.05	2.83	5.88	
- back	constr.	1.1.1	3.05	2.83	5.88	
FRONT CB	strength	1.1.2	?	3.11	6.16	
BACK CB	strength	1.1.2				
SEAT						
- canvas	- constr.	1.1.1	4.00	1.89	5.89	
	- strength	1.1.2	.83	1.89	2.72	
	- design	2.1	5.83	1.89	7.72	
- screws	- joints	1.1.3	1.00		1.00	
- thread	- joints	1.1.3				
- wood	- constr.	1.1.1	1.02		1.02	
round	- strength	1.1.2	1.02	1.31	2.33	
supports	- joint.	1.1.3	1.02	1.31	2.33	
BACK	- constr.	1.1.1	1.00		1.00	
- canvas	- comfort	2.2	5.83	1.89	7.72	
- fittings	- comfort (tilt)	2.2	1.00		1.00	
- wood	- joints	1.1.3	1.53	.60	2.13	
- thread						
KD Fittings	KD	3.2	3.00	.28	3.28	
Packaging	Pack.	4.	10.00	1.19	11.19	
Finishing	Design	2.1	4.50		4.50	
Filling						
Total			59.88	30.64	90.52	

FUNCTION COST ANALYSIS MATRIX (form No. 5) FOR FURNITURE MANUFACTURING

Product: SAFARI
Page: ___/___
Date: ___/___

Part \ Functions	1.1. Construction	1.1.1. Make Construction	1.1.2. Give Strength	1.1.3. Joints	1.2. Other use Values	2.1. Design	2.2. Comfort	2.3. Other Prestige	3.1. Cost Value	3.2. [illegible]	4. Package	Cost of part	Percentage
SIDE = ARMREST	(12.82)	9.00	3.82			5.95						18.77	20.7
LEG	(11.76)	11.76										11.76	13.0
CROSS BARS	(6.16)		6.16									6.16	6.8
SEAT	(5.29)	6.91	5.05	3.33		7.72						23.01	25.4
BACK	(3.13)	1.00		2.13			8.72					11.85	13.1
K.D - FITTINGS										3.28		3.28	3.6
PACKAGE											11.19	11.19	12.4
FINISHING & FILLING						4.50						450	5.0
Cost of function	(49.16)	28.67	15.03	5.46		18.17	8.72			3.28	11.19	90.52	100
[illegible]	543	31.7	16.6	6.0		20.1	9.6			3.6	12.4	100	
Is the cost too high?		?	?								YES		

VALUE DETERMINATION (form No. 6) Page /

Product SAFARI Project No. 82-07

Date 82-04-13

Value type/Function	Cost	Per cent
1.1. CONSTRUCTION	(49.16)	(54.3)
1.1.1. Construction	28.67	31.7
1.1.2. Strength	15.03	16.6
1.1.3. Joints	5.46	6.0
2.1. Design	18.17	20.1
2.2. Comfort	8.72	9.6
3.4. K D	3.28	3.6
4. Package	11.19	12.4
TOTAL	90.52	100

Comments: The cost of package is high but it also serves as sales promoter.

The chair is not very comfortable. Also the cost of comfort is low.

The designer on the team made sketches on his pad, which were also documented for evaluation at a subsequent meeting (see figure V).

At the end of the creative session the team decided whether they wanted all the alternatives to be calculated or only those for which they wanted to know the cost effect. In this case most of the results were obvious, and the team decided to accept certain ideas; the co-ordinator was to prepare calculations for the next meeting.

At the next meeting he had a sketch (figure VI) and detailed cost calculations of the new chair. The team decided to accept the chair, and form No. 9 was filled out. If there had been more alternatives, form No. 8 would probably also have been used. But as seen, form No. 7 can also be used for evaluation, using the space for "cost effect" and indicating decisions with A (if accepted) and with R (if rejected).

The comparison shows the savings in both material and labour:

	Old	New	Difference (per cent)
Materials	59.88	50.52	15.6
Labour (min)	(61.28)	(50.97)	16.8
FIM	30.64	25.48	16.8
Direct cost, total	90.52	76.00	16.0
Overhead requirement (min)	49.02	40.78	16.8
Standard price 0.80 FIM	139.54	116.78	16.3
Chosen price	?	?	?

The price remains to be chosen, taking into consideration that the product is now a better one.

The work of the value-analysis team resulted in a new chair with a better value, i.e., better suitability and lower cost in production and delivery (see figure VII).

The savings are listed as follows:

Material

- Fewer dowels
- Shorter dimensions
- Lower side part eliminated
- Less canvas needed in the back

Accessories

- Cheaper system of attaching the canvas - using screws and a screwdriver
- Screwdriver
- Cheaper KD fittings

Package and assembly

- Smaller package needed
- Less space needed for warehousing

Corresponding labour savings

The suitability is improved because the chair:

Is much easier to assemble

Is more comfortable

Seat better

Arm rest wider

Even the design is better although, that is really a matter of taste.

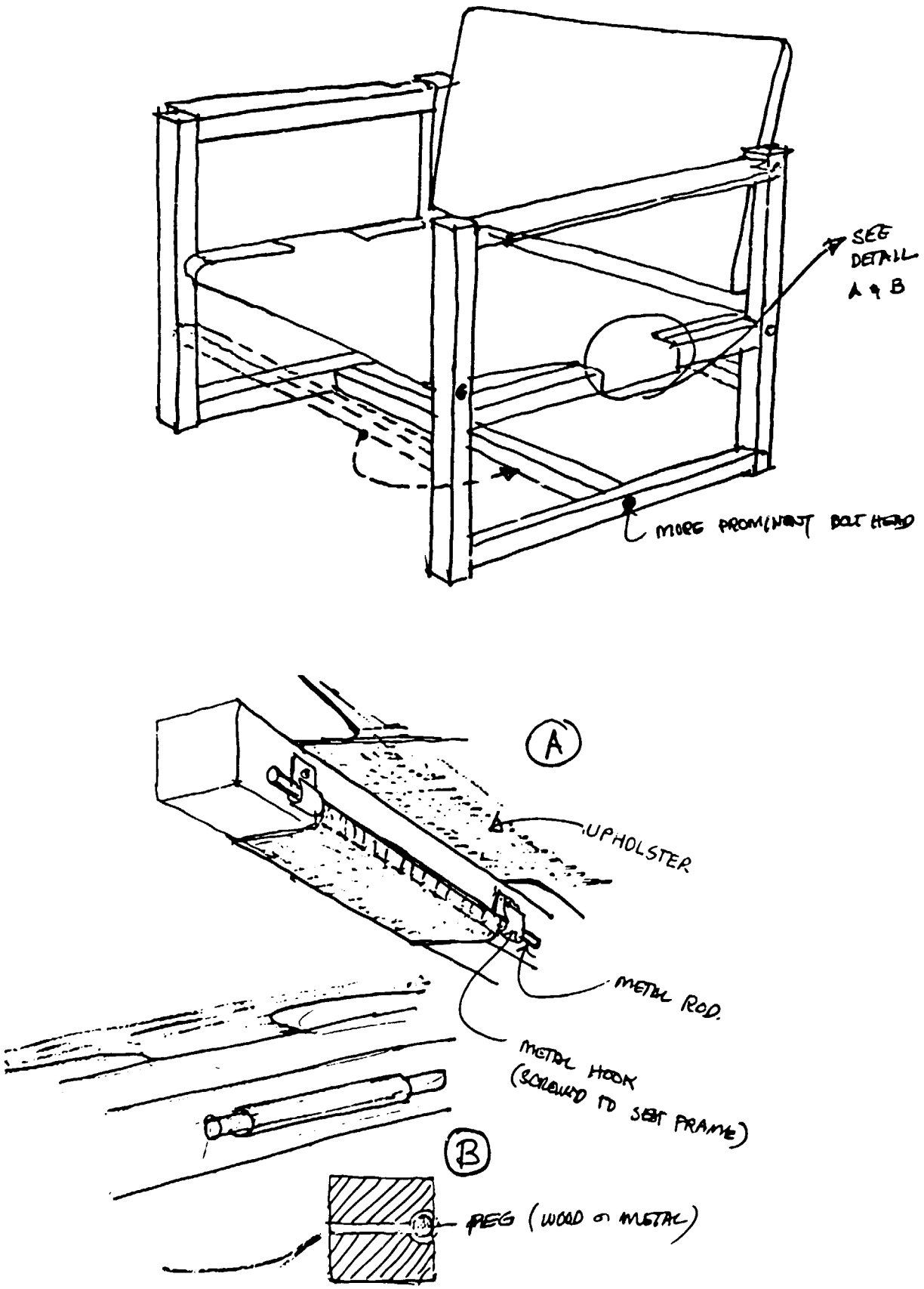

Figure V. Sketches the designer made (creative phase)

CREATIVE PHASE (form No. 7) Page 1/6

Product SAFARI Project No.

Date

Part		Ideas		Cost effect
THE	1	ROUND PARTS	R	
CHAIR	2	USE LEATHER	R	
AS SUCH	3	COMBINE THE BACK & SEAT	To idea bank	
	4			
	5			
	6			
	7			
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CREATIVE PHASE

Page 2 / 6

Product SAFARI

Project No.

Date

Part	Ideas		Cost effect
SIDES	1 ELIMINATE LOWEST B.	A	
	2 ELIMINATE MIDDLE B	R	
	3 ELIMINATE UPPER BAR	R	
	X AND USE CANVAS INSTEAD		
	5 MAKE UPPER BAR WIDER	A	
	X TO FUNCTION AS REAL ARM-		
	X REST.		
	8 SHORTEN DIMENSIONS OF	A	
	X BARS		
	10 USE THINNER MATERIAL IN	R	
	X THE MIDDLE AND IN THE		
	X LOWER BAR		
	13		
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CREATIVE PHASE

Page 3/6

Product SAFARI

Project No.

Date

Part	Ideas		Cost effect
LEGS	1 BACK LEG HIGHER + 30CM	R	
	2 ROUND MATERIAL	R	
	3 SHORTEN LEGS AND LET	R	
	X THE ARMREST TO COME OVER		
	5 PUT WHEELS	R	
	6		
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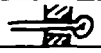
CREATIVE PHASE Page 4/6

Product SAFARI Project No.

Date

A = accept R = reject

Part	Ideas	A/C	Cost effect
SEAT	1 ELIMINATE ATTACHMENT OF CANVAS	R	
	~~2~~ TO SIDES		
	3 USE SINGLE PLY FABRIC	A	
	4 USE THICKER BUT CHEAPER FABRIC	A	
	5 SEAT & BACK TO BE ONE PIECE	R	
	6 ATTACH CANVAS TO UPPER SIDE	R	
	~~7~~ RAILS = ARMREST		
	8 ATTACH CANVAS WITH PRESS	R	
	~~9~~ BUTTONS		
	10 USE DARK SEWING THREAD TO	R	
	~~11~~ GIVE DESIGN		
	12 FRONT SUPPORT HIGHER TO	R	
	~~13~~ GIVE BETTER SITTING POSITION		
	14 ATTACH. SEAT TO SIDES ONLY	R	
	15 ATTACHMENT WITH DOWEL STICK	A	
	~~16~~ 		
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CREATIVE PHASE

Page 5/6

Product SAFARI

Project No.

Date

Part	Ideas		Cost effect
BACK	1 ELIMINATE TILTING (EXCESS OF)	R	
	2 COMBINE SEAT AND BACK	To idea bank	
	3 HIGHER BACK LEGS, ATTACH	R	
	X BACK TO LEGS		
	5 USE SINGLE-PLY CANVAS	A	
	6 LOWER TO SAVE MATERIAL	R	
	7 RESERVE AN EMPTY SPACE	A	
	8 BETWEEN BACK AND SEAT		
	9		
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CREATIVE PHASE

Page 6/6

Product

Project No.

Date

Part	Ideas		Cost effect
KD-FITTINGS	1 USE SIMPLIFIED CONSTRUCTION	A	
	~~2~~ AS IN PICTURE		
	~~3~~		
	~~4~~		
	~~5~~		
	~~6~~		
	7		
	8		
	9		
	10 MAKE A STANDARD VERSION	R	
	11 FOR HOME MARKE WITHOUT		
	12 KD CONSTRUCTION		
	13		
HEXAG.	14 ELIMINATE IF KD ELIMINATED	R	
WRENCH	15		
	16		
SCREW	17 ELIMINATE	A	
DRIVER	18		
	19		
	20		
	21		
CARRY-	22 PRINT IMPROVED INFORMATION	A	
AWAY	~~23~~ ON TOP		
PACKAGE	24 SAVE MATERIAL IF DIMENSIONS	A	
	~~25~~ ARE REDUCED		
	26 USE SILK-SHRINCK METHOD	R	
	27		
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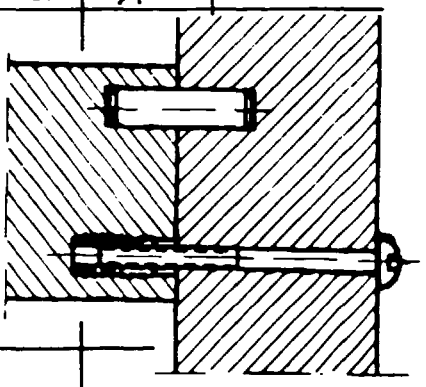

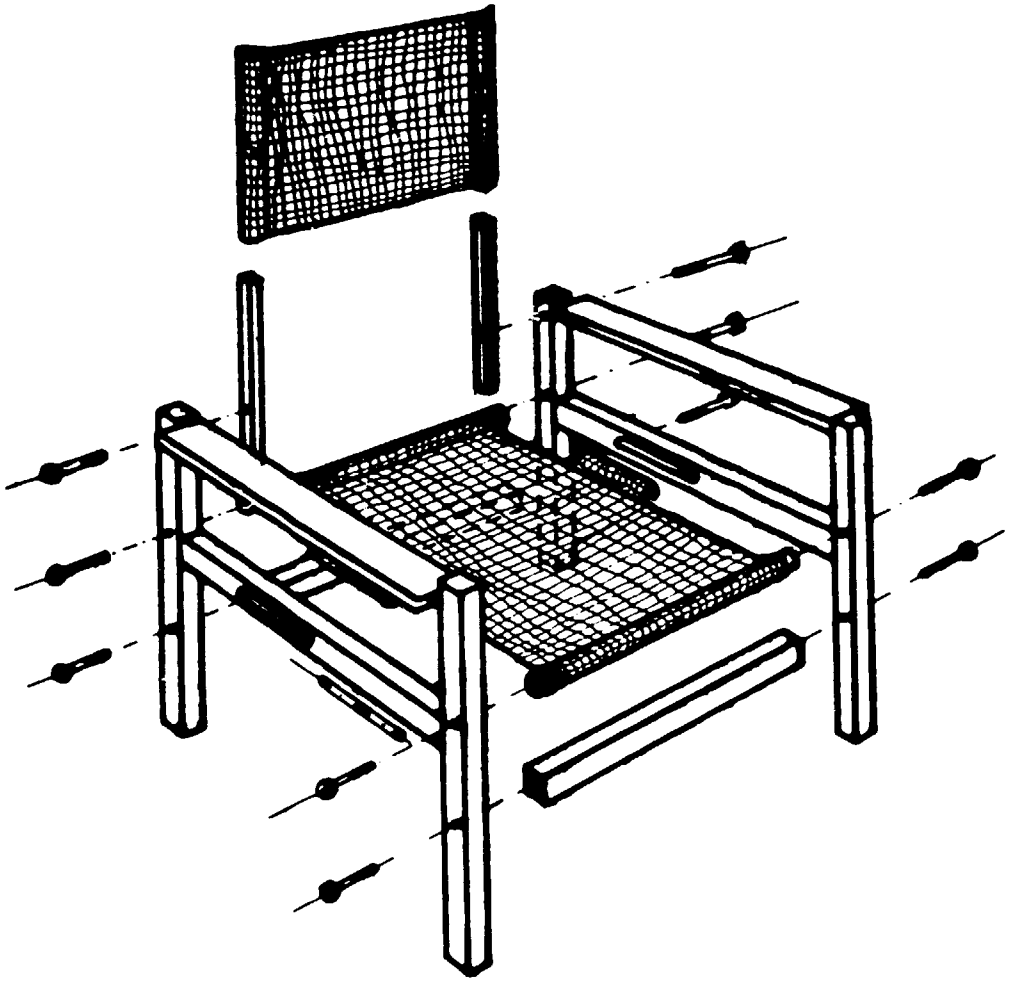

Figure VI. The result of a case-study of value analysis of the Safari chair

PRODUCT COST (form No. 12) | PRODUCT: Safari chair (after VA)

Estimate ☒ | Prototype ☐ | Control ☐ | 19___ | 19___ | 19___

MATERIALS	Net	μ	Gross	1) a'/ FIM/prod.	FIM/prod	2) a'/ FIM/prod.	FIM/prod.	3) a'/ FIM/prod.	FIM/prod.
Pine	.0122	.5	.0244	800,-	19.52				
Canvas			.60	20,-	12.00				
Varnish	.150	1/3	.450	10,-	4.50				
Accessories					4.50				
Packingmaterial					10.00				
Total raw material cost					50.52				

Capacity required	min/pcs	eff-%	min/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs
	45.87	90	50.97	.50	25.48				

Direct cost total: 76,-

Capacity needed	min/pcs	eff-%	min/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs	FIM/min	FIM/pcs
Overhead	45.87	90	50.37	.80	40.78				

Standard price: 116.78

Standard price incl. tax: 135.32

Chosen price

Chosen price incl. tax

Chosen overhead contribution FIM/pcs

Chosen overhead contribution FIM/min

COMMENTS

PART/OPERATION MATRIX (form No. 12) | PRODUCT: ...ular chair ...ter VA) | 82-04-07 | BY | PAGE 1 / 2

PART / Picture / Description / Dimensions	Front leg				Back leg				Side parts				Cross bars				Armrest				TOTAL
	2		545 × 45 × 45		2		545 × 45 × 45		2		490 × 45 × 45		2		490 × 45 × 45		2		187 × 70 × 30		
OPERATION	pcs/prod	pcs/oper	m/pcs	m/prod	pcs/prod	pcs/oper	m/pcs	m/prod	pcs/prod	pcs/oper	m/pcs	m/prod	pcs/prod	pcs/oper	m/pcs	m/prod	pcs/prod	pcs/oper	m/pcs	m/prod	m/prod
[illegible] Sawing	2	1	.10	.20	2	1	.10	.20	2	1	.10	.20	2	1	.10	.20	2	1	.10	.20	1.00
E[illegible]			.11	.22			.11	.22			.11	.22			.11	.22			.11	.22	1.10
C[illegible]			.09	.18			.09	.18			.09	.18			.09	.18			.09	.18	.90
T[illegible]	↓	↓	.09	.18	↓	↓	.09	.18			.09	.18			.09	.18			.09	.18	.90
Cut 15° end									↓	↓	.29	.58	↓	↓	.29	.58	↓	↓	.29	.58	1.74
[illegible] 7 [illegible]																					
Cut [illegible] 1	2	1	.19	.38	2	1	.19	.38													.76
[illegible] 2																					
E[illegible]	2	1	.21	.42	2	1	.21	.42	2	1	.21	.42	2	1	.21	.42	2	1	.21	.42	2.10
[illegible]																					
[illegible]									2	1	.55	1.10									1.10
S[illegible]		1	.42	.84	2	1	.42	.84			.42	.84	2	1	.42	.84	2	1	.42	.84	4.20
[illegible]		2	.05	.20		2	.05	.20		2	.05	.20		2	.05	.20		2	.05	.20	1.00
[illegible]		1	.35	.70		1	.35	.70			.35	.70		1	.35	.70		1	.35	.70	3.50
[illegible]			.20	.40			.20	.40			.20	.40			.20	.40			.20	.40	2.00
[illegible]			.30	.60			.30	.60			.30	.60			.30	.60			.30	.60	3.00
[illegible]	↓	↓	.20	.40	↓	↓	.20	.40	↓	↓	.20	.40	↓	↓	.20	.40	↓	↓	.20	.40	2.00
[illegible]																					
[illegible]	2	1	.83	1.66																	1.66
[illegible]	1		1.07	1.07																	1.07
[illegible]	1	↓	.50	.50																	.50
[illegible]																					
TOTAL				7.35				4.72				6.02				4.92				4.92	28.53

PART/OPERATION MATRIX | PRODUCT: Safari chair (after VA) | 82-04-07 | BY | PAGE 2 / 2

PART / Picture / Description / Dimensions	Round supports 2	490 × Ø42			Lock trip for seat 2	150 × Ø10			Back wood pcs				Upholstery				Transfer from page 1				TOTAL
OPERATION	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	pcs/prod	pcs/oper	min/pcs	min/prod	min/prod
Cross cutting	2	1	.10	.20	2	1	.02	.04	2	1	.05	.10								1.00	1.34
Edging	↓	↓	.11	.22	2	1	.03	.06	↓	↓	.05	.11								1.10	1.49
Planing	↓	↓	.09	.18							.04	.09								.90	1.17
Trimming	↓	↓	.09	.18	2	1	.01	.02	↓	↓	.04	.09								.90	1.20
Drill 1 st end	↓	↓	.29	.58																1.74	2.32
2 nd end																					
Drill slot 1									2	1	.19	.38								.76	1.14
slot 2																					
End welding																				2.10	2.10
Trip plane					2	1	.02	.04													.03
Routing																				1.10	1.10
Painting																				4.20	4.20
Sanding wide belt																				1.00	1.00
narrow belt	2	1	.35	.70	2	1	.20	.40	2	1	.15	.30								3.50	4.90
1 st spray	↓	↓	.20	.40																2.00	2.40
Sanding between	↓	↓	.30	.60																3.00	3.60
2 nd spray	↓	↓	.20	.40																2.00	2.40
Sawing to ends	↓	↓	.15	.30																	.30
Final assembly																				1.66	1.66
Packing																				1.07	1.07
Packing of fittings																				.50	.50
Cutting & sewing																11.95					11.95
TOTAL				3.73				.56				1.07								28.53	45.87

PROJECT SUMMARY (form No. 9)

82-04-20

Product NEW SAFARI

Part

Project No. 82-07

Drawings No. 82-09

New price/piece 120

Pieces/year 2 000 or more

Cost/year

Goal savings		percent =	18 100	FIM/year
Previous costs	2000 x	90.50 =	181 000	FIM/year
New costs	2000 x	76.00 =	152 000	FIM/year
Savings	2000 x	14.50 =	29 000	FIM/year

Percentage-savings = 16

Cost of analysis 22 manhours x 50 Fim 1 100 FIM

Other costs drawings + proto 2 000 FIM

First-year savings 25 900 FIM/year

Comments Because of lower price and improved functions the value is now higher and so higher sales figures are expected

Ideas to be further developed

THE CHAIR WITH COMBINED CANVAS SEAT AND BACK IS TO BE DEVELOPED

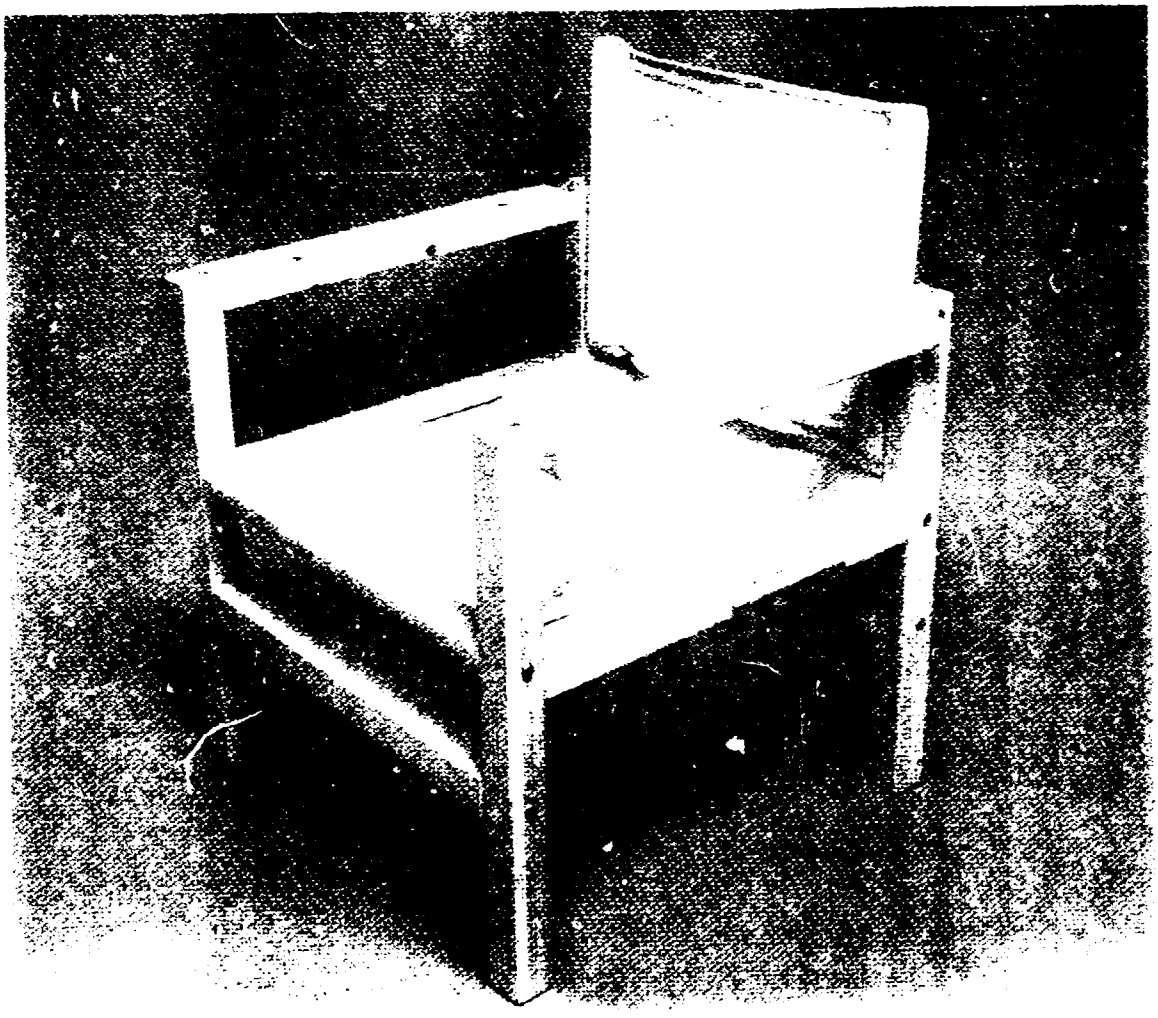

Figure VII. The new Safari chair

The details of the changes in chairs produced are shown in figures VIII and IX.

Figure VIII. Detail of the Safari chair before value analysis, showing original arm rest, method of fixing the seat material and bottom lateral rail

Figure IX. Detail of the Safari chair after value analysis, showing the modified arm rest, method of fixing the seat material and the elimination of the bottom lateral rail

The following studies relating to wood processing industries have been prepared by the United Nations Industrial Development Organization and some have been issued as sales publications:

United Nations. Production of panels from agricultural residues. Report of an expert working group meeting, Vienna, 14-18 December 1970. September 1983. 37 p. (ID/79)
Sales no.: 72.II.E.4.

_____ Production of prefabricated wooden houses [Prepared by Keijo N. E. Tiusanen]. June 1971. 94 p. (ID/61)
Sales no.: 71.II.B.13.

_____ Production techniques for the use of wood in housing under conditions prevailing in developing countries. Report of study group, Vienna, 17-21 November 1969. January 1971. 39 p. (ID/10)
Sales no.: 70.II.B.32.

_____ Wood as a packaging material in the developing countries [Prepared by B. Hochart]. (ID/72)
Sales no.: 72.II.B.12.
Currently out of print.

United Nations Industrial Development Organization. Adhesives in the wood processing industries. Report of a workshop, Vienna, Austria, 31 October-4 November 1977. February 1979. 29 p. (ID/223)

_____ Documentation and information systems for furniture and joinery plants. A manual for developing countries. 1991. (ID/SER.O/4)
Sales no.: UNIDO.92.4.E.
Previously appeared as "Manual on documentation and information systems for furniture and joinery plants in developing countries" under the symbol ID/315.

_____ Expert Group Meeting on Timber Construction, Vienna, Austria, 2-6 December 1985: report. May 1986. 40 p. (ID/WG.447/17)

_____ Furniture and joinery industries for developing countries. April 1989. 371 p. (ID/108/Rev.2)
Sales no.: E.88.III.E.7.

_____ Low-cost automation for the furniture and joinery industry [Prepared by W. Santiano and H. P. Brion]. January 1983. 143 p. (ID/154/Rev.1)

_____ Low-cost pre-fabricated wooden houses. A manual for developing countries. 1991. (ID/SER.O/5)
Sales no.: UNIDO.92.5.E.
Previously appeared as "Popular manual for wooden house construction" under the symbol ID/330.

_____ Manual on jigs for the furniture industry [Prepared by P. J. Paavola and K. Ilonen]. July 1981. 63 p. (ID/265)

_____ Manual on the production of rattan furniture [Prepared by D. P. Cody]. June 1983. 108 p. (ID/299)

_____ Manual on upholstery technology [Prepared by D. P. Cody]. February 1982. 90 p. (ID/275)

Production management for small- and medium-scale furniture manufacturers. A manual for developing countries [Prepared by E. Q. Canela]. 1991. (ID/SER.O/3)
Sales no.: UNIDO.92.3.E.
Previously appeared as "Production management for small- and medium-scale furniture manufacturing firms in developing countries" under the symbol ID/300.

Report on the Expert Group Meeting on Timber Stress Grading and Strength Grouping, Vienna, Austria, 14-17 December 1981. (ID/WG.359/7)
Currently out of print.

Selection of woodworking machinery. Report of a Technical Meeting, Vienna, 19-23 November 1973. October 1974. 35 p. (ID/133)

Technical criteria for the selection of woodworking machines. Rev. ed. 1992.
Sales no.: UNIDO.92.1.E.

Timber construction for developing countries. Introduction to wood and timber engineering. 1991. (ID/SER.O/6)
Sales publication, forthcoming.

Timber construction for developing countries. Structural timber and related products. 1991. (ID/SER.O/7)
Sales publication, forthcoming.

Timber construction for developing countries. Durability and fire resistance. 1991. (ID/SER.O/8)
Sales publication, forthcoming.

Timber construction for developing countries. Strength characteristics and design. 1991. (ID/SER.O/9)
Sales publication, forthcoming.

Timber construction for developing countries. Applications and examples. 1991. (ID/SER.O/10)

Value analysis in the furniture industry [Prepared by A. Juva]. 73 p. 1991. (ID/SER.O/2)
Sales no.: UNIDO.92.2.E.
Previously published under the symbol ID/298.

Wooden bridges. UNIDO's prefabricated modular system. January 1984. 16 p. (PI/88)

Wood processing for developing countries. Report of a Workshop, Vienna, 3-7 November 1975. October 1976. 79 p. (ID/180)

UNIDO guides to information sources. No. 4: Information sources on the furniture and joinery industry. (UNIDO/LIB/SER.D/4/Rev.1) (ID/188)
Currently out of print.

No. 6: Information sources on industrial quality control. November 1980. 71 p. (UNIDO/LIB/SER.D/6/Rev.1) (ID/256)

No. 9: Information sources on building boards from wood and other fibrous materials. (UNIDO/LIB/SER.D/9)
Currently out of print.

No. 18: Information sources on the paint and varnish industry. (UNIDO/LIB/SER.D/18) (ID/150)
Currently out of print.

No. 31: Information sources on woodworking machinery. October 1978. 100 p. (UNIDO/LIB/SER.D/31) (ID/214)

No. 35: Information sources on utilization of agricultural residues for the production of panels, pulp and paper. November 1979. 99 p. (UNIDO/LIB/SER.D/35) (ID/234)

No. 36: Information sources on industrial maintenance and repairs. November 1979. 88 p. (UNIDO/LIB/SER.D/36) (ID/236)

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